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BASIC DIMENSIONS OF FINANCIAL CONDITION WITHIN THE DEFENSE INDUSTRY

by

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November 1995

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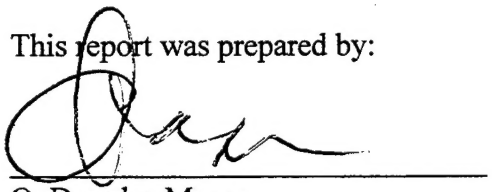

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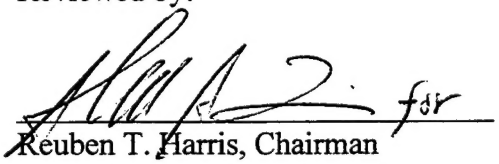

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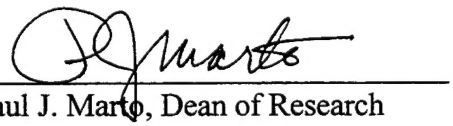

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Financed Analysis of Defense Industry firms, as conducted within DoD, typically involves the analysis of financial condition as measured by financial ratios. The objective of this study was to identify the basic dimensions of financial condition in the defense industry and the specific financial ratios that best reflect those dimensions. An empirical analysis of 51 financial ratios for 50 defense firms over a 10 year period was conducted. Findings indicate there are eight basic dimensions of financial condition and that those dimensions are stable across varying circumstances.

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BASIC DIMENSIONS OF FINANCIAL CONDITION WITHIN THE DEFENSE INDUSTRY

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BASIC DIMENSIONS OF FINANCIAL CONDITION WITHIN THE DEFENSE INDUSTRY

ABSTRACT

CONTEXT: Organizations within the Department of Defense are frequently required to perform financial analysis of private sector firms, typically in support of acquisitions and procurement activities or in support of analyses of the defense industrial base. Most financial analyses conducted within DoD rely on observing financial ratios for a firm or industry. Since there are literally hundreds of ratios that can be constructed and analyzed, a typical analysis focuses on a small set of ratios (e.g., current ratio, return on equity) generally picked from some commonly accepted categories (e.g., liquidity, profitability). Such an approach makes two assumptions: (1) that individual ratios appropriately reflect broader concepts (e.g., that a current ratio reflects liquidity) and (2) that, collectively, the set of ratios analyzed comprehensively reflects all relevant aspects of financial condition.

These assumptions raise various questions; two fundamental ones are: First, what are the basic dimensions of financial condition? Second, what individual ratios are most representative of these dimensions?

OBJECTIVE: The broad objective of the research reported in this paper was to identify the fundamental dimensions of financial condition within the defense industry and identify specific financial ratios that best reflect these dimensions. This was done by examining patterns exhibited by financial ratios of defense industry firms.

ANALYSIS: The analysis was conducted using data from a sample of 50 large defense contractors for a 10 year period (1983-92). Fiftyone distinct financial ratios were calculated for each firm for each year. Factor Analysis was used to empirically isolate common dimensions or "factors" underlying the set of ratios.

FINDINGS: The findings indicate that there are eight basic dimensions of financial condition in the defense industry. Three reflect the intensity or success of operations (Turnover, Profitability, and Cashflow); five reflect aspects of financial position (Cash Position, Inventory, Asset Composition, Liquidity and Leverage). Individual ratios that best measure these dimensions of financial condition can be identified. Both the basic dimensions and the most representative ratios are stable over time, over different economic conditions, and across different industry segments.

IMPLICATIONS: The central implications of the research findings are that (a) to be comprehensive, a financial analysis within the defense industry needs to cover the various, distinct dimensions of financial condition, (b) such a comprehensive analysis can be achieved by looking at about eight common ratios.

BASIC DIMENSIONS OF FINANCIAL CONDITION WITHIN THE DEFENSE INDUSTRY

BACKGROUND AND OBJECTIVE:

Financial analysis is necessarily related to cost analysis as it is practiced in the defense acquisition and contracting setting. When formal cost estimates are created for acquisition programs within the Department of Defense (DOD), they are routinely accompanied by a contractor financial analysis. This linkage comes from the need to integrate knowledge of the financial condition of the defense industry and specific contractors into defense contracting decisions.

Financial Analysis in DoD:

Financial analysis is conducted at various agencies in DoD and the military services, typically within the acquisition and financial management communities. The Defense Contract Audit Agency (DCAA) and the Defense Contract Management Command (DCMC) routinely conduct financial analyses in support of the contract award and management process. Activities within each of the military services -- the Naval Center for Cost Analysis (NCA), the Army Center for Resource Analysis and Business Practices (ACRABP), the Air Force's Office of Economic and Business Management (OEBM) -- conduct financial analysis in support of the milestone review process and to assess the financial health of their respective service's industrial base.

The practice of financial analysis by the activities within DoD has been documented previously (Borah, 1995). Financial analysis as practiced across these various activities is broadly similar with respect to objectives and approaches but quite diverse with respect to procedures. All activities are concerned with assessing the health/stability/capability of defense firms; all tend to rely heavily on financial information reported in financial statements; all tend to construct a set of financial

ratios from the financial statement information; all tend to interpret these financial ratios as measures of some aspect of a defense firm's financial condition (such as liquidity, solvency, profitability). But practices differ greatly with respect to what aspects of financial condition are focused on, which financial ratios are constructed, and how financial ratios are organized and combined leading to a conclusion.

Financial Ratios Used:

Financial capability analysis within DCAA, for example, (DCAA ,1990) focuses on five ratios:

- Working Capital/Total Assets
- Retained Earnings/Total Assets
- Earnings/Total Assets
- Equity/Total Liabilities
- Sales/Total Assets

These are combined in a failure prediction model (Altman, 1968). Analyses conducted by ACRABP involve the construction of 14 ratios reflecting solvency, efficiency and profitability (Borah, 1995, p.34). Analyses conducted by NCA emphasize six ratios:

- Total Liabilities/Total Assets
- Cash Flow/Total Debt
- Current Assets/Current Liabilities
- Quick Assets/Total Assets
- Working Capital/Total Assets
- Sales/Total Assets

These are also combined in a failure prediction model, the "Navy-Z" model (Dagel and Pepper, 1990). Financial stability analysis within DCMC is guided by a publication (DCMC, 1992) which provides 50 ratios from four broad categories. But one form formally used to report financial analyses (DLA Form 1407) pays particular attention to three ratios reflecting liquidity and leverage:

- Current Assets/Current Liabilities;

- Quick Assets/Current Liabilities;
- Total Liabilities/Stockholders Equity

The broad conclusions to be drawn from these various applications of financial analyses within DoD are (a) that there is consensus that financial ratios form the foundation of any financial analysis, (b) that individual ratios are useful because they are measures of more general aspects of financial condition, such as "profitability", "liquidity" and "leverage", but © that there is no agreement about which specific ratios, and how many, should be incorporated in an analysis.

How many ratios should be considered when conducting an analysis? Which ones? How many is too many? How are financial ratios interrelated? Which ratios are redundant? No consistent framework exists for the identification, selection and interpretation of financial ratios when conducting a financial analysis of defense industry firms.

Objective of Study:

The broad objective of this study is to provide a framework for applying and understanding financial ratios within the defense industry. More specifically, the objectives of the study are to identify the basic dimensions of financial conditions existing within the defense industry and the specific financial ratios most representative of those dimensions. Specific research questions addressed include:

- What are the primary dimensions of financial condition for the defense industry?
- What individual financial ratios are most representative of the identified dimensions of financial condition?
- Are the dimensions of financial condition for defense contractors stable across time?
- Are the ratios that are most representative of each dimension consistent across time?

- Are the major dimensions (and representative ratios) consistent across periods of both economic growth and decline?
- Are the major dimensions (and representative ratios) similar or different across different segments of the defense industry?
- Does change in financial condition occur along basic dimensions?

The general approach used to address these questions is to categorize ratios using an empirically based classification methodology (factor analysis) which takes in account the relationships between and among ratios.

Benefits of the Study:

There are two primary benefits from the study: First, the identification of the basic financial dimensions of the industry results in a general framework applicable for understanding industry condition and organizing a financial analysis. Second, the identification of specific ratios which "best" represent particular aspects of financial condition provides an approach for selecting ratios to be included in an analysis. The framework provides a guide for selecting a small set of ratios which, collectively, are necessary and sufficient for a comprehensive financial analysis.

Related Research:

Financial ratios have long been a primary tool for analyzing financial condition of companies. The central virtue of ratios is that they have consistently been shown to be predictors/indicators of items or events of interest, such as stock price, financial risk, mergers, bond ratings or yields, and financial impairment or bankruptcy.[1] Studies have also documented that financial ratios are indicators of events of specific relevance to the

[1]The literature is extensive. Some classic studies include: financial risk (Beaver, Kettler and Scholes, 1970; Gonedes, 1973; Rosenberg and McKibben, 1973), bond yields or ratings (Horrigan, 1966; Pinches and Mingo, 1973; West, 1970) mergers (Simkowitz and Monroe, 1971; Stevens, 1973) and financial impairment or bankruptcy (Altman, 1968; Beaver, 1966).

defense contracting industry. For example, financial ratios are related to the failure of defense contractors (Dagel and Pepper, 1990; Moses and Liao, 1987) contractor pricing strategy (McGrath and Moses, 1987) and program cost overruns (Moses, 1989).

Motivated by the obvious usefulness of financial ratios, researchers have previously developed empirically-based classification frameworks to organize ratio analysis. Early studies attempted to develop taxonomies of financial ratios. A taxonomy is a grouping of a set of ratios into several categories, with the ratios within a category reflecting a single construct, and ratios in different categories reflecting conceptually different constructs. The common approach used is a technique, factor analysis, which statistically examines the manner in which ratios do (or do not) co-vary, and groups them accordingly. If several ratios tend to co-vary, they will define a factor. The technique can be used to reduce a large set of variables to a smaller set of factors that efficiently represent the same information.

Pinches, Mingo, and (Caruthers, (1973) and Pinches, Eubank, Mingo and Caruthers (1975) analyzed 48 financial ratios by factor analysis and found that they empirically fell into seven ratio groups which they labeled:

- Return on Investment,
- Capital Intensiveness,
- Inventory Intensiveness,
- Financial Leverage,
- Receivables Intensiveness,
- Short-Term Liquidity,
- Cash Position.

They further documented that these groups tended to be stable across time. Chen and Shimerda (1981) applied the Pinches et.al. classification framework to other studies and concluded that ratio categories in other studies were consistent with, and could be reconciled with, the Pinches et.al. groups. The broad conclusion inferable from these studies was that the Pinches et.al. framework was generally valid, broadly inclusive and stable.

Later studies expanded the kinds of data from which financial ratios were

constructed, expanding the types of ratios examined, to see if new ratios could be encompassed by the Pinches et.al. framework. To the extent that new ratio measures fall within the framework, it can be considered inclusive. Findings indicated that general price-level adjusted ratios formed categories similar to those identified by Pinches et.al. (Short, 1978; Gombola and Ketz, 1983a). But ratios based on cash flow data (Gombola and Ketz, 1983a; 1983b) and "decomposition measures" (Johnson, 1979) defined new factors beyond the groups identified by Pinches et.al. These findings indicate that, while "broadly" inclusive, the Pinches et.al framework is not "all" inclusive.

Most directly relevant to current study are studies that have been concerned with ratio differences, and differences in ratio taxonomies, across industries. It is widely accepted that values for ratios are dependant on industries, with values being somewhat similar within an industry and different across industries (Gupta and Huefner, 1972). Do ratio categories or taxonomies also differ across industries? If so, then the Pinches et.al. framework cannot be considered "generally" valid. Gombola and Ketz (1983b) compared factors identified within the retail and manufacturing industries, observing substantial similarity but noting the existence of a Return on Sales factor present for retail firms but not for manufacturers. Jensen and Ketz (1987) found that a cash flow factor may be distinct from profitability for industries with a long operating cycle, but less so in industries with a short operating cycle. More recently, Ketz, Doogar and Jensen (1990) conducted a broad study of ratio taxonomies across seven different industries. They found a seven factor framework which was consistent across time and across six of the seven industries (the retail industry was an exception). Six of the factors in their seven category framework were similar to those of Pinches et.al. But Ketz et.al. additionally identified a cash flow factor.

The overall implications of the existing literature is that financial ratios can be usefully and meaningfully grouped in terms of identifiable dimensions and that there are broad similarities in the frameworks produced by different studies. But the frameworks and dimensions have not been universally consistent -- and some of the differences are industry related. The purpose of this study then is to develop a framework specifically

applicable to the defense industry.

METHODOLOGY

Sample:

The sample used for the analysis consisted of 50 defense contractors. Three criteria were considered in sample selection:

1. Significance of defense contract business: Firms were selected from the top 100 defense companies as listed in Defense 93 Almanac (1993), which ranks contractors in terms of dollar value of DoD prime contracts awarded.

2. Diversity: Firms were selected to represent various industry sectors, or subindustries, within the general area of defense contracting. The defense contracting industry can be categories into seven broad sectors (Military Forum, 1988) in terms of contract type, as follows: (1) Ships, (2) Tank and Automotive, (3) Aircraft, (4) Missiles, (5) Training Systems and Services, (6) Computers and Data processing, and (7) Electronics and Communication. Firms were selected from each sector, with greater emphasis on the greater volume sectors. Many sample firms operate in more than one sector.

3. Sample Size: A sample size of 50 was arbitrarily set as sufficient for performing the statistical tests. The 50 sample firms are listed in Table 1, along with their Standard Industrial Classification (SIC) codes (from industrial Compustat, 1987). Firms with SIC codes in the 3600s are associated with computers/electronics. Firms with SIC codes in the 3700s are associated with vehicles/aircraft/missiles. Distinctions based on SIC codes are used later in the analysis. Of the sampled firms, 36 were among the top 50 defense contractors; the remaining 14 were from the second 50.

Data and Time Period:

Financial statement data were collected for the 50 firms from annual reports, 10k reports and Moody's Industrial Manuals for the period 1983-1992. The 10-year length is arbitrary but designed to be sufficiently short as to represent recent years but also

sufficiently long as to encompass varying economic conditions for the industry. More specifically, the time period includes both the early years of the Reagan administration, when defense spending was growing and the industry was healthy, and the early 1990s, when recession and the end of the Cold War brought declining defense budgets and lean times for the industry.

Selecting Ratios:

It is inevitable that the results from a factor analysis of ratios will be somewhat dependant on the set of ratios analyzed.[2] Having too many or too few ratios of a particular type will bias the analysis toward finding or not finding a particular factor or dimension. One could simple use all possible ratios that could be calculated from some data set (i.e., financial statements) but that would obviously lead to the inclusion of many meaningless ratios (e.g., interest payable/accumulated depreciation). One could also simple use all ratios that had been identified in some existing body of literature (e.g., texts on financial statement analysis; research on financial dimensions), but that would not assure a balance across different kinds of ratios. So there was a need to pre-select ratios on some basis prior to the analysis. Any approach is necessarily ad hoc. The following approach was used:

First, a population of potential ratios was identified: all ratios included in the prior studies of financial dimensions (Chen and Shimesda, 1981; Gombola and Ketz, 1983a; Ketz, Doogar and Jensen, 1990; Pinches et.al., 1973, 1975). There is considerable overlap among those studies, with many ratios being minor modifications of others, and some merely being reciprocals.

Second, all of these ratios were grouped into plausible categories. This step relied on my own internal conceptual structure for organizing ratios, as discussed in the next section.

Third, a number of ratios from each category were selected to get a representative

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[2]This was noted as well by Chen and Shimerda, 1981, in their attempt to reconcile the findings of various other studies.

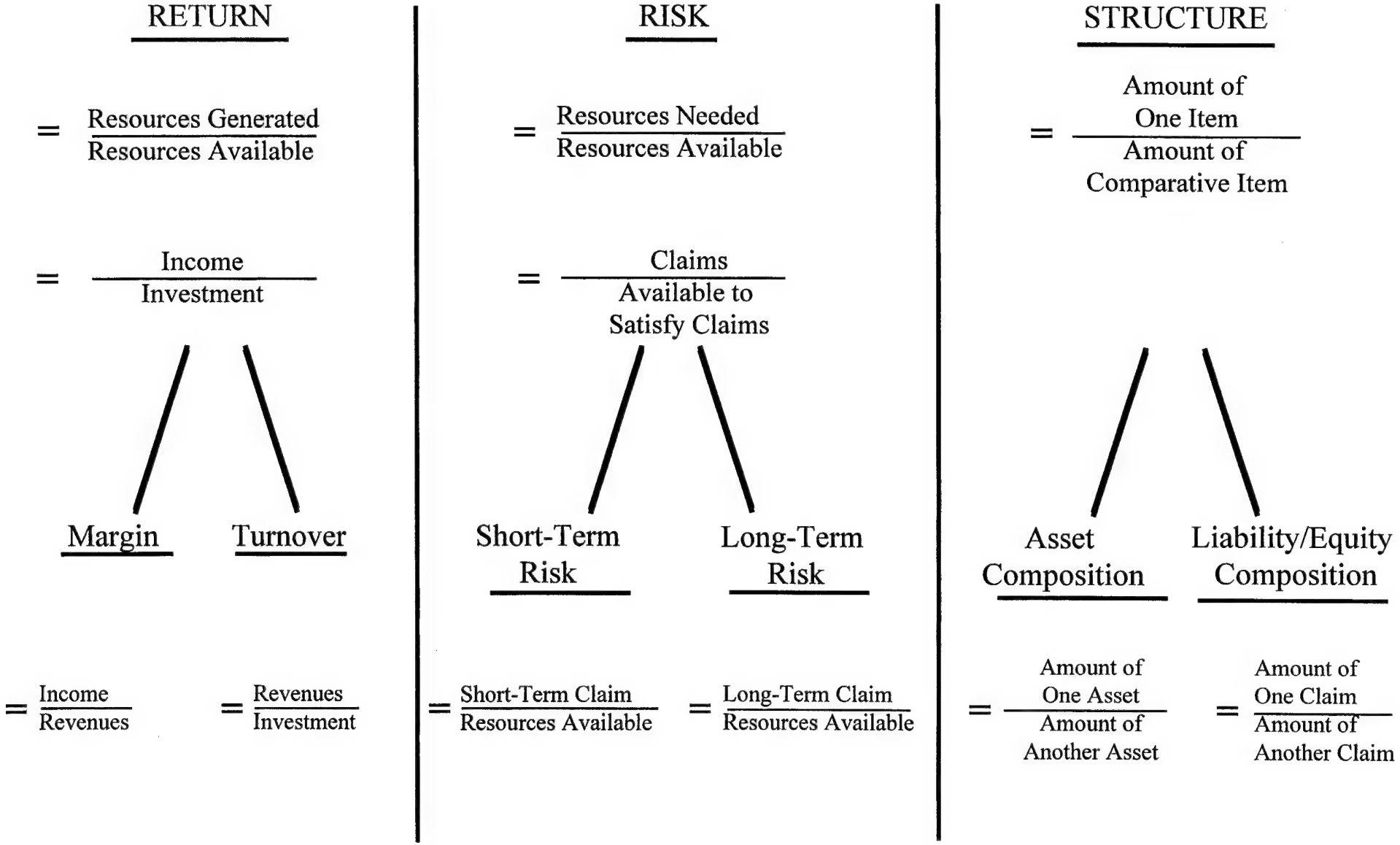
Table 1

SAMPLE FIRMS

AND SIC CODES

1	ALLIED SIGNAL	3664	26	HEWLETT-PACKARD	3680
2	AT&T	4811	27	HONEYWELL	3680
3	BLACK & DECKER	3540	28	IBM	3680
4	BOEING	3721	29	ITT	3661
5	CHRYSLER	3711	30	JOHNSON CONTROLS	3822
6	COASTAL	4922	31	KAMAN	9999
7	COMPUTER SCIENCE CORP.	7372	32	LOCKHEED	3760
8	CONTROL DATA	3680	33	LORAL	3664
9	CSX	4011	34	LTV	3310
10	DYNAMICS	3600	35	MARTIN MARIETTA	3760
11	EASTMAN KODAK	3861	36	MCDONNELL DOUGLAS	3721
12	EATON	3820	37	MORRISON KNUDSEN	1600
13	EG&G	8911	38	MOTOROLA	3663
14	E-SYSTEMS	3664	39	NORTHROP	3721
15	FMC	2800	40	OLIN	2800
16	FORD	3711	41	RAYTHEON	3664
17	GENCORP	3000	42	ROCKWELL INTERNATIONAL	3721
18	GENERAL DYNAMICS	3721	43	TELEDYNE	3720
19	GENERAL ELECTRIC	3600	44	TEXAS INSTRUMENTS	3674
20	GENERAL MOTORS	3711	45	TRINITY	3440
21	GRUMMAN	3721	46	TRW	3663
22	GTE	4811	47	UNITED INDUSTRIES	9999
23	HARRIS	3663	48	UNISYS	3680
24	HARSCO	3440	49	UNITED TECHNOLOGIES	3720
25	HERCULES	2800	50	WESTINGHOUSE	3600

FIGURE 1


RETURN
= Resources Generated / Resources Available
= Income / Investment
Margin
Turnover
= Income / Revenues
= Revenues / Investment
RISK
= Resources Needed / Resources Available
= Claims / Available to Satisfy Claims
Short-Term Risk
Long-Term Risk
= Short-Term Claim / Resources Available
= Long-Term Claim / Resources Available
STRUCTURE
= Amount of One Item / Amount of Comparative Item
Asset Composition
Liability/Equity Composition
= Amount of One Asset / Amount of Another Asset
= Amount of One Claim / Amount of Another Claim

set. The intent was to select ratios from each category that were not "too" similar (to achieve diversity). Ratios that were essentially reciprocals of others were not selected.

Ratio Categories:

My internal framework[3] for organizing ratios is summarized in Figure 1. Broadly, all financial statement information is seen as measuring either Resources (assets), Claims against resources (liabilities and owners equity), or Changes in resources or claims. Also, all ratios (constructed from financial statement data) are seen as reflecting one of three basic constructs: Return, Risk or Structure. Thus Return, Risk and Structure ratios are just comparisons of Resources, Claims, and Changes in Resources and Claims, selectively chosen.

Conceptually, Return ratios compare two things: the resources generated during a period from operating with the resources available to operate with. Generally this implies relating some measure of income with some measure of investment (both broadly defined). Return rests on two legs: Margin and Turnover. Margin relates income to revenues; Turnover relates revenues to investment. There are a number of manifestations of these basic Return, Margin and Turnover ratios depending on how one conceives of, and measures, income, revenue and investment.

Conceptually, Risk ratios compare two things: the resources needed to satisfy some claim against the firm with the resources available to satisfy the claim. Most ratios commonly thought to measure liquidity, solvency, and leverage are versions of Risk ratios. They differ only in how one conceives of, and measures, the claim to be satisfied (e.g., current liabilities, total liabilities, period interest cost) and the resources available to satisfy it (e.g., current assets, total assets, period earnings or cash flows). A convenient way to segment risk ratios is in terms of whether the claim is to be satisfied is short- or long-term.

A number of ratios that appear in other studies cannot conveniently be associated

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[3]I don't claim great novelty here. Obviously, my framework is based on my learning from the literature.

with either Risk or Return. Instead they appear to reflect something about the composition of resources (assets) or claims (liabilities, owners equity) -- structure of the firm. Conceptually, Structure ratios compare the amount of one resource/claim with the amount of another (frequently larger, more inclusive) resource/claim. Such ratios differ, of course, in terms of which resources or claims are compared. A convenient way to group Structure ratios is in terms of whether they convey the composition of assets or of equities. Numerous examples of Structure ratios can be constructed. Inventory/Current Assets and Current Assets/Total Assets convey something about the composition of current and total assets, respectively. Current Liabilities/Total Liabilities reflect the composition of creditor claims.

Table 2 contains a list of (51) financial ratios, selected from the larger population to represent categories within this framework. A notation is used where all ratios are represented by four letters: the first two signifying the numerator; the last two, the denominator. Each ratio was calculated for each of the 50 firms for each of the 10 years. Means for each ratio, by year, are presented in Table 3.

Many of the distributions of the ratios were non-normal and highly skewed. Transformation of the ratio values was necessary to prevent extreme values from driving the results.[4] A two-step process was used. Ratio values were ranked ordinally. Then ordinal ranks were normalized. This resulted in normal distributions for all ratios, retaining the original relative order for values, but removing extremes while deleting no values.[5]

The Factor Analysis Technique:

The classification schemes reported in this study were developed via a statistical

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[4]Various kinds of transformations were considered. Log transformations were rejected because of negative and fractional ratio values. Truncation and "winsorizing" were rejected as arbitrary.

[5]Initial tests were also conducted on the untransformed ratios with no substantive difference in findings.

TABLE 2

RATIO LIST AND NOTATION

RATIOS	NOTATION
RETURN: ------- CISE CITA CICP NISE NITA NICP CFSE CFTA CFCP MARGIN: GPSA CISA NISA CFSA TURNOVER: ON TOTAL INVESTMENT: SASE SATA SACP ON SPECIFIC ASSETS: SACH SAAR SAIN SAQA SACA SAFA RISK: ----- SHORT TERM: CHCL QACL CACL CFCL CICL SACL LONG TERM: LEVERAGE: TLTA CFTL TASE CITL NLCP NITL NLFA CHTL CPFA INTEREST COV. CHIE CFIE CIIE NIIE STRUCTURE: ---------- ASSET COMPOSITION: CURRENT: INCA WCIN QAIN ARIN TOTAL: CHTA QATA CATA WCTA EQUITY COMPOSITION: CLTL CLSE	INCOME STATEMENT AND CASHFLOW ITEMS: ---------- CI = INCOME FROM CONTINUING OPERATIONS NI = NET INCOME CF = CASHFLOW FROM OPERATIONS GP = GROSS PROFIT SA = SALES IE = INTEREST EXPENSE BALANCE SHEET ITEMS: ---------- CH = CASH & MARKETABLE SECURITIES AR = ACCOUNTS & NOTES RECEIVABLE IN = INVENTORY QA = QUICK ASSETS CA = CURRENT ASSETS WC = WORKING CAPITAL FA = FIXED (NONCURRENT) ASSETS TA = TOTAL ASSETS CL = CURRENT LIABILITIES NL = NONCURRENT LIABILITIES TL = TOTAL LIABILITIES CP = INVESTED CAPITAL (NL+SE) SE = STOCKHOLDERS EQUITY

TABLE 3

AVERAGE FINANCIAL RATIO VALUES: 1983-1992

RATIO	Y1983	Y1984	Y1985	Y1986	Y1987	Y1988	Y1989	Y1990	Y1991	Y1992	ALLYEARS
CISE	0.14	0.16	0.08	0.10	0.14	0.12	0.08	0.13	0.05	0.10	0.11
NISE	0.14	0.16	0.09	0.10	0.14	0.12	0.10	0.13	0.04	-0.08	0.09
CFSE	0.32	0.30	0.28	0.27	0.21	0.19	0.19	0.33	0.28	0.36	0.27
CITA	0.06	0.07	0.04	0.03	0.05	0.04	0.03	0.04	0.02	0.03	0.04
NITA	0.06	0.07	0.05	0.03	0.06	0.04	0.04	0.04	0.02	-0.00	0.04
CFTA	0.15	0.13	0.12	0.12	0.08	0.06	0.06	0.09	0.09	0.09	0.10
CICP	0.07	0.07	0.04	0.04	0.05	0.04	0.03	0.04	0.03	0.04	0.05
NICP	0.06	0.07	0.05	0.04	0.05	0.05	0.04	0.04	0.02	0.01	0.04
CFCP	0.15	0.13	0.12	0.12	0.08	0.06	0.06	0.09	0.09	0.10	0.10
GPSA	0.25	0.24	0.24	0.22	0.25	0.24	0.24	0.24	0.23	0.23	0.24
CISA	0.05	0.05	0.03	0.02	0.05	0.04	0.03	0.03	0.02	0.03	0.03
NISA	0.05	0.05	0.03	0.02	0.06	0.03	0.03	0.03	0.01	-0.00	0.03
CFSA	0.11	0.09	0.09	0.09	0.07	0.06	0.06	0.08	0.08	0.08	0.08
SATA	1.44	1.46	1.38	1.32	1.23	1.25	1.22	1.26	1.23	1.25	1.30
SACP	1.46	1.46	1.38	1.33	1.22	1.24	1.22	1.26	1.25	1.26	1.31
SASE	3.54	3.53	3.56	3.29	3.36	3.44	3.74	4.19	3.77	4.50	3.69
SACH	109.79	177.03	90.46	84.46	79.68	93.30	110.92	60.43	54.92	64.03	92.50
SAAR	11.10	9.40	9.98	8.39	7.89	7.04	7.05	7.53	7.95	9.00	8.53
SAIN	21.14	10.67	9.81	10.84	11.40	13.00	13.66	13.48	14.01	14.84	13.29
SAQA	4.69	4.87	4.64	4.40	3.96	3.84	3.86	4.07	3.93	3.98	4.22
SACA	2.99	2.92	2.83	2.81	2.53	2.51	2.52	2.64	2.59	2.70	2.70
SAFA	3.69	3.48	3.22	2.84	2.78	2.94	2.78	2.84	2.88	2.87	3.03
CHCL	0.38	0.25	0.21	0.20	0.24	0.19	0.15	0.17	0.21	0.24	0.22
QACL	1.20	1.05	1.03	1.05	1.14	1.19	1.11	1.10	1.16	1.19	1.12
CACL	1.77	1.63	1.60	1.60	1.66	1.72	1.61	1.60	1.64	1.65	1.65
CFCL	0.53	0.44	0.41	0.42	0.28	0.21	0.21	0.30	0.29	0.32	0.34
CICL	0.25	0.23	0.14	0.07	0.20	0.14	0.12	0.13	0.08	0.12	0.15
SACL	4.97	4.50	4.26	4.29	3.95	4.09	3.87	4.05	3.99	4.16	4.21
TLTA	0.54	0.55	0.56	0.59	0.64	0.66	0.67	0.67	0.66	0.68	0.62
TASE	2.45	2.39	2.64	2.52	2.94	3.01	3.38	3.66	3.40	4.24	3.06
NLCP	0.22	0.21	0.22	0.23	0.26	0.27	0.29	0.30	0.29	0.32	0.26
CHTL	0.21	0.17	0.14	0.12	0.12	0.10	0.07	0.08	0.11	0.11	0.12
NLFA	0.49	0.44	0.43	0.50	0.64	0.71	0.70	0.69	0.68	0.74	0.60
CPFA	2.40	2.27	2.20	2.07	2.28	2.34	2.25	2.21	2.30	2.27	2.26
CFTL	0.32	0.27	0.24	0.22	0.13	0.11	0.11	0.15	0.16	0.16	0.18
CITL	0.14	0.14	0.10	0.07	0.10	0.08	0.06	0.07	0.05	0.07	0.09
NITL	0.13	0.15	0.10	0.08	0.11	0.08	0.07	0.07	0.05	0.02	0.09
CHIE	12.45	12.41	12.32	15.94	13.20	19.18	12.04	20.63	17.81	16.93	15.29
CFIE	17.69	21.33	16.67	13.39	6.00	10.60	3.53	17.52	12.24	12.20	12.95
CIIE	7.67	9.67	7.06	5.94	5.78	2.43	5.39	7.85	4.92	4.52	6.13
NIIE	8.75	10.28	8.06	7.03	7.27	-2.85	6.47	8.20	7.66	6.12	6.72
INCA	0.34	0.37	0.37	0.35	0.33	0.31	0.32	0.31	0.30	0.29	0.33
WCIN	1.97	1.38	1.20	1.50	1.72	1.88	1.88	1.68	2.00	1.90	1.71
QAIN	3.72	2.58	2.43	2.92	3.95	4.47	4.64	4.51	5.13	5.43	3.99
ARIN	1.50	1.35	1.33	1.53	1.86	2.15	2.31	2.29	2.44	2.50	1.93
CHTA	0.10	0.08	0.07	0.06	0.07	0.05	0.04	0.05	0.06	0.07	0.07
QATA	0.33	0.32	0.31	0.31	0.34	0.35	0.34	0.34	0.35	0.36	0.34
CATA	0.52	0.52	0.50	0.48	0.51	0.52	0.51	0.50	0.50	0.50	0.50
WCTA	0.20	0.18	0.16	0.15	0.16	0.18	0.16	0.15	0.16	0.16	0.17
CLTL	0.60	0.63	0.62	0.58	0.56	0.55	0.55	0.55	0.56	0.53	0.57
CLSE	0.80	0.82	0.92	0.85	1.05	1.07	1.23	1.34	1.22	1.56	1.08

procedure called factor analysis (Harman, 1976; Kim and Mueller, 1978). Factor analysis empirically analyzes the interrelationships among a set of variables, identifying where variables co-vary. Variables that are similar, that do co-vary, are grouped along a common factor. Variables that are dissimilar are associated with different factors. Thus the method is designed to abstract, from a large set of variables, a smaller set of factors that efficiently represent the larger set. The factors can be interpreted as basic dimensions underlying the larger set of variables.

Beyond identifying factors, the procedure produces various output of interest. Each factor has an eigenvalue which measures the amount of variance in the set of ratios explained by a factor. Eigenvalues greater than one mean a factor explains more variance than exists in any single variable. Typically, a factor analysis procedure is stopped (no new factors are identified) when the variance explained by a new factor is less than the variance within an single individual variable.

Factor loadings are the correlations between individual variables (ratios) and factors (dimensions). Loadings are observed to determine which factor a given ratio is most highly associated with and to determine which ratios are most representative of a given factor.

Commonality estimates indicate the proportion of the variance in an individual variable explained collectively by the set of identified factors. If the commonality is high for a variable, one has confidence that the information contained in the variable is reflected by the factors.

Factor analysis was conducted on the full sample, as well as various subsamples, to address the research questions. In each case, all factors with eigenvalues in excess of one were extracted and reported. Orthogonal rotation was used to produce factors uncorrelated with each other.[6]

ANALYSIS AND FINDINGS

[6]Findings by Ketz et.al., (1990), indicate that factor analyses of financial ratios using alternative techniques, such as oblique rotation, tend to produce similar results.

What are the basic dimensions of financial condition in the defense industry?

The first step in the analysis was designed to address this broad question. A factor analysis was conducted on all ratios for all sample firms from all 10 years. All factors with eigenvalues greater than one were extracted, resulting in eight identifiable dimensions. Table 4 displays the factor pattern that resulted. In table 4, factors are ordered (1 to 8) from highest to lowest eigenvalues. Eigenvalues ("variance explained by each factor") are listed at the bottom of the table. Values for factors 2-8 are of similar magnitude (4 to 6), indicating that each factor "explains" about 4 to 6 times the amount of variance exiting in any single ratio. In other words, each factor taps into some underlying construct that manifests itself in several individual ratios. Factor 1 is a dominant factor, with a substantially higher eigenvalue than the others.

The values in the table are factor loadings (correlations of ratios with factors, multiplied here by 100). The ratios are listed in order of decreasing loading, along each successive factor, with asterisks (*) indicating loadings that tend to be significant. The factor analysis procedure is simply a mechanical statistical exercise producing a factor pattern. "Meaning" comes from observing the loadings, interpreting the relationships between ratios and factors, and labeling the factors in terms of the underlying construct they appear to represent.

The first 13 ratios in Table 4 load most heavily on Factor 1 and all contain NI or CI, two measures of income, in their construction. So this first factor is clearly reflecting "Profitability." It is interesting to note that these ratios come from different categories in the ex ante framework discussed earlier (Table 2). NICP, NITA, CITA, CICP, NISE, CISE are all measures of Return; NISA an CISA are measures of Margin; CICL is a short-term Risk measure; while CITL, NITL, CIIE and NIIE are long-term Risk measures (with NIIE and CIIE being versions of the familiar times-interest-earned ratio). But the important point is that empirically all of these ratios are highly interrelated; differences in these ratios across firms are driven by differences in Profitability.

Four ratios, CACL, QACL, SACL, and CLSE, load most heavily on Factor 2. Ex ante, CACL, QACL, and SACL were seen as reflecting short-term Risk, while CLSE was

TABLE 4

FACTOR PATTERN
FULL SAMPLE

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
NICP	92 *	16	14	11	5	3	-15	4
NITA	92 *	16	13	11	5	4	-16	4
CITA	90 *	13	19	15	8	8	-19	8
CICP	90 *	14	18	16	7	7	-19	8
NISE	90 *	-13	11	9	3	4	11	5
NITL	87 *	29	14	6	8	4	-24	4
NISA	87 *	9	9	-33	11	-3	-1	3
CISE	86 *	-19	16	14	3	8	12	10
CISA	86 *	3	13	-35 *	14	1	-4	8
CITL	85 *	28	17	9	11	6	-29	7
CICL	83 *	43 *	18	5	6	-5	-2	11
NIIE	80 *	10	13	7	21	4	-30	-5
CIIE	77 *	8	14	9	23	6	-34	-1
CACL	12	87 *	2	-4	10	39 *	20	-7
QACL	14	76 *	8	-11	21	37 *	17	38 *
SACL	22	75 *	14	57 *	-6	-4	8	8
WCTA	11	74 *	-1	2	13	61 *	14	-11
WCIN	12	71 *	7	-9	19	44 *	16	32
TASE	-33	-66 *	-9	3	-11	3	64 *	5
TLTA	-33	-67 *	-9	2	-13	4	63 *	2
CLSE	-25	-90 *	-10	8	-7	20	20	4
CFTA	26	6	93 *	17	8	0	-9	6
CFCP	26	7	93 *	17	8	0	-9	7
CFSA	14	-4	89 *	-33	13	-4	8	10
CFTL	31	24	86 *	12	11	-2	-24	6
CFSE	6	-29	86 *	14	7	3	29	15
CFCL	24	39 *	85 *	6	8	-12	9	7
CFIE	32	5	74 *	9	19	-5	-32	5
SACP	22	16	9	87 *	-11	18	-27	4
SATA	22	15	9	87 *	-11	19	-27	4
SACA	17	2	15	81 *	-17	-46 *	-8	12
SASE	-12	-42 *	0	75 *	-17	18	35 *	7
SAQA	7	-4	5	73 *	-27	-41 *	-4	-41 *
SAFA	18	19	1	67 *	1	64 *	-20	-3
SAAR	8	-6	24	62 *	30	-1	18	-5
GPSA	13	12	5	-48 *	-6	-9	-2	9
CHTA	15	3	12	2	94 *	18	-7	8
CHCL	15	29	13	-2	91 *	6	5	9
CHTL	20	18	13	1	90 *	14	-20	8
CHIE	24	5	15	2	85 *	9	-29	7
SACH	-6	4	-7	28	-93 *	-13	-5	-10
CPFA	6	11	-8	9	15	96 *	-6	-5
CATA	6	12	-8	10	15	96 *	-7	-5
QATA	11	10	3	-3	24	79 *	-8	51 *
NLCP	-31	2	-2	-7	-11	-20	90 *	-3
NLFA	-30	7	-8	-4	-9	24	87 *	-7
CLTL	21	-35 *	-1	12	9	31	-83 *	3
QAIN	8	1	12	-15	24	15	3	92 *
SAIN	13	-3	21	35 *	8	-12	2	87 *
ARIN	8	12	1	-6	-18	-14	-17	83 *
INCA	-8	-1	-12	15	-24	-15	-3	-92 *

TE: Printed values are multiplied by 100 and rounded to the nearest integer.
Values greater than 0.339208 have been flagged by an '*'.

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
11.188033	6.034717	5.873656	5.572161	5.043701	4.676881	4.508705	4.047423

seen as an indicator of Liability/Equity Composition. The common element for all four is CL; hence this factor seems to reflect most strongly the magnitude of current liabilities, relative to other financial items, particularly relative to current and liquid assets, conventional indicators of short run liquidity. Thus this factor will be labeled "Liquidity".

Factor 3 is fairly unambiguous. The seven ratios loading highly all incorporate CF, thus reflecting Cash Flow from Operations. And none of these seven ratios (with a small exception for CFCL) loads significantly on any other factor. Thus "Cash Flow" is a distinct dimension of financial condition.

Factor 4 is also unambiguous. Eight ratios are most strongly associated with Factor 4 and each involves Sales. Further, with the exception of GPSA, all relate sales generated to some measure of investment or assets. In short, "Turnover" is the dimension underlying this factor.

Factor 5 contains five ratios that clearly reflect the asset cash and can be labeled "Cash Position." Again, it is interesting to note that the five ratios were, ex ante, seen as different kinds of measures; specifically, Asset Composition (CHTA), Turnover (SACH) and short- (CHCL) or long-term Risk (CHTL, CHIE). But empirically differences in cash position across firms cause the differences in these ratios.

Three ratios (CPFA CATA, QATA) load most heavily on Factor 6. And some others (e.g., SAFA, WCTA) also contribute. There is a common theme among these ratios. They are increased by higher values for current assets and decreased by higher values for noncurrent assets. Conceptually, this dimension reflects the current vs. noncurrent make up of assets and is labeled "Asset Composition."

Three ratios (NLCP, NLFA, CLTL) also load most heavily on Factor 7, with a couple of others (TASE, TLTA) contributing significantly. Again, a common thread is apparent: the amount of liabilities, specifically noncurrent liabilities, drive these ratios. They may be thought of as reflecting long-run Risk (e.g., NLCP, TASE) or the composition of liabilities (e.g., CLTL) but "Leverage" appears to be the most descriptive label.

Lastly, four ratios (QAIN, SAIN, ARIN, INCA) make up Factor 8. SAIN is conventionally a turnover ratio, while the other three reflect the composition of current assets. But the more basic common element among the ratios is "Inventory," the ratios loading positively or negatively with the factor depending on whether IN is in the denominator or numerator.

Table 5 displays the communality estimates for the ratios, which are measures of the proportion of each ratio's variance that is explained by the eight factors collectively. Note that most values are greater than .90, with a few smaller but still greater than .80. The exceptions are for GPSA and SAAR. These two ratios, particularly GPSA, appear to contain some information not fully incorporated in the eight dimensions of financial condition identified. (If the factor analysis procedure is permitted to extract additional factors, GPSA and SAAR load, individually, on the next two factors, numbers 9 and 10. But each factor has an eigenvalue less than one, implying less information in the factors than in the specific ratios themselves.) Collectively, the commonality estimates total 46.94, indicating that the factors explain 92% (46.94/51) of the variance in the 51 ratios. In short, the finding is that the eight factors reflect well the information (variance) contained in the full set of ratios.

In Summary, the findings to this point are:

1. There are eight basic dimensions of financial condition that underlie financial ratios within the defense industry.
2. Individual ratios tend to be associated with specific dimensions.
3. The dimensions reflect well the information contained in the larger set of ratios.
4. The dimensions are interpretable in terms of understandable concepts such as profitability, turnover, cash flow, etc.

What ratios are most representative of the basic financial dimensions?

This question can also be answered from the factor pattern in Table 4. Ratios with high loadings on a factor are most highly correlated with, and hence representative

TABLE 5

COMMONALITY ESTIMATES

Final Communality Estimates: Total = 46.945278

CISE	NISE	CFSE	CITA	NITA	CFTA	CICP	NICP	CFCP	GPSA	CISA	NISA	CFSA
.860309	0.859861	0.948662	0.941477	0.928502	0.982456	0.937439	0.928554	0.982614	0.286613	0.906310	0.892258	0.959499

SATA	SACP	SASE	SACH	SAAR	SAIN	SAQA	SACA	SAFA	CHCL	QACL	CACL	CFCL
.960813	0.960878	0.944818	0.981479	0.571209	0.953042	0.958174	0.969099	0.967547	0.974477	0.967886	0.977475	0.971832

CICL	SACL	TLTA	TASE	NLCP	CHTL	NLFA	CPFA	CFTL	CITL	NITL	CHIE	CFIE
.935208	0.969902	0.972640	0.975682	0.967736	0.967758	0.931889	0.985072	0.977896	0.945466	0.927209	0.896771	0.804554

CIIE	NIIE	INCA	WCIN	QAIN	ARIN	CHTA	QATA	CATA	WCTA	CLTL	CLSE
.796693	0.807814	0.979033	0.890308	0.979033	0.794524	0.969330	0.973814	0.986534	0.984654	0.968624	0.983852

of, the factor. If several ratios load approximately as strongly on a factor, each could be a candidate. Perhaps fortunately, for each of the eight factors, among the highest loading ratios are ones that are commonly seen in the practice of financial analysis and intuitively coincide well with the dimension they represent. Selecting from Table 4:

FACTOR	DIMENSION	RATIO	COMMON NAME
1	PROFITABILITY	NICP	Return on Capital
2	LIQUIDITY	CACL	Current Ratio
3	CASH FLOW	CFTA	CashFlow to Total Assets
4	TURNOVER	SACP	Capital Turnover
5	CASH POSITION	CHTA	Cash to Total Assets
6	ASSET COMPOSITION	CATA	Current to Total Assets
7	LEVERAGE	NLCP	Long-Term Debt Ratio
8	INVENTORY	INCA	Inventory to Curr. Assets

Are the dimensions and representative ratios stable across time and circumstances?

A factor analysis could be conducted on any large set of variables and factors would be extracted by the procedure. One test of whether the identified factors are valid is whether they are interpretable in terms of an underlying construct. Another test is whether they explain a large proportion of the variance in the set of variables. The findings from the prior analysis seems to pass both these tests. A third test of whether the factor description is valid, and perhaps more important, useful, is that the factors are stable, that they appear under different sets of conditions.

To test for stability, two subsamples were drawn from the full sample. One consisted of ratios for the years 1983-86; the other for 1989-92. Subsamples of four year length are somewhat arbitrary, but were chosen to permit a sufficiently large sample size (n = 50 firms x 4 years = 200), while still leaving a separation in time (two years) between the two subsamples.

Political and economic conditions also differed noticeably between the periods represented by the two subsamples. The years 1983-6, the early Reagan years, were a

period of investment in defense and a generally expanding economy. The years 1989-92 encompass the end of the cold war, declining defense spending and recession. Defense industry financial condition also differed: Gursoy (1995) compared the financial condition of 37 large defense firms during two time periods similar to the present study (1983-85 and 1990-92) and found significantly lower profitability (NISA, NITA), turnover (SATA), cash (CHCL) and higher leverage (TLSE, TASE, TLTA) during the later period.

In short, the two subsamples are distinct in terms of time, political and economic circumstances, and industry financial condition. Are the underlying dimensions of financial condition stable despite the various changes that occurred? A separate factor analysis was conducted on the two subsamples. Detailed factor patterns are displayed in Appendix A. Observing the factor patterns and comparing with Table 4 reveals a remarkable degree of similarity among the three analyses. In each case,

- Eight factors resulted (eigenvalues greater than one).
- One dominant Profitability factor is evident (Factor 1).
- Factors 2-8 have roughly comparable eigenvalues.
- The factor labels developed for the full sample are readily applicable to the subsamples. (The order of entry is slightly different across the samples but this is of no importance.)
- The same ratios tend to load with comparable strength on the same factors.

This last point is perhaps most important, as factors are meaningful or interpretable only in terms of the ratios that comprise them. Table 6 reinforces the common patterns. In an attempt to summarize the comparison, Table 6 lists the three ratios with the highest loading on each factor (in descending order) within each sample. For each subsample a ratio is highlighted in bold in the table if it coincides with one of the ratios listed for the full sample. Only five ratios are not highlighted. In short, the ratios defining the factors, and most representative of those factors, are almost identical across the three samples -- and more importantly when the 1983-86 and the 1989-92 samples are compared. Broadly, the finding is that the eight basic dimensions of financial condition within the industry are robust; they continue to emerge from samples reflecting distinctly different

Table 6

COMPARISON OF FACTORS AND REPRESENTATIVE RATIOS ACROSS DIFFERENT TIME PERIODS			
FACTOR	**FULL SAMPLE**	**1983-86**	**1989-90**
PROFITABILITY	FACTOR 1:	FACTOR 1:	FACTOR 1:
	NICP	**NICP**	**NICP**
	NITA	**NITA**	**NITA**
	CITA	**CITA**	**CITA**
LIQUIDITY	FACTOR 2:	FACTOR 2:	FACTOR 4:
	CLSE	**CLSE**	**CLSE**
	CACL	**CACL**	**CACL**
	QACL	WCIN	**QACL**
CASH FLOW	FACTOR 3:	FACTOR 3:	FACTOR 3:
	CFTA	**CFTA**	**CFTA**
	CFCP	**CFSA**	**CFCP**
	CFSA	**CFCP**	CFCL
TURNOVER	FACTOR 4:	FACTOR 4:	FACTOR 2:
	SACP	**SACA**	**SATA**
	SATA	**SACP**	**SACP**
	SACA	**SATA**	**SACA**
CASH POSITION	FACTOR 5:	FACTOR 6:	FACTOR 7:
	CHTA	**SACH**	**CHTA**
	SACH	**CHTA**	**CHCL**
	CHCL	**CHCL**	CHTL
ASSET COMPOSITION	FACTOR 6:	FACTOR 5:	FACTOR 6:
	CPFA	**CPFA**	**CATA**
	CATA	**CATA**	**CPFA**
	QATA	SAFA	**QATA**
LEVERAGE	FACTOR 7:	FACTOR 8:	FACTOR 5:
	NLCP	**NLFA**	**NLCP**
	NLFA	**NLCP**	**CLTL**
	CLTL	**CLTL**	**NLFA**
INVENTORY	FACTOR 8:	FACTOR 7:	FACTOR 8:
	INCA	**INCA**	**INCA**
	QAIN	**QAIN**	**QAIN**
	SAIN	ARIN	**SAIN**

conditions.

Do different segments of the defense industry exhibit the same financial dimensions?

The defense "industry" is of course made up of companies that operate in a number of different industry groups, segments or subindustries. Are the basic financial dimensions robust across the different segments? Is conceptualizing financial condition in terms of these basic dimensions applicable to all industry segments?

To address this question, three subsamples were drawn from the full sample, based on SIC code. The "Platform" subsample (n=13) consisted of firms with SIC codes in the 3700s. These tend to be firms (e.g., General Dynamics, Lockheed) that are contractors for weapon system platforms such as aircraft, missiles, tanks, etc. The "Electronic" subsample (n=17) consisted of firms with SIC codes in the 3600s. These tend to be firms (e.g., Honeywell, Motorola) that are contractors for electronics or computer-based systems. The "Other" subsample (n=18) consisted of all other sample firms and, of course, is diverse.[7]

A separate factor analysis was conducted on each subsample. Detailed factor patterns are in Appendix B. Observing the factor patterns and comparing with Table 4 again reveals substantial similarity among the three industry segments. In each case,

- Eight factors resulted (eigenvalues greater than 1).
- One dominant Profitability factor is evident (Factor 1).
- Factors 2-8 have roughly comparable eigenvalues.
- The factor labels developed for the full industry are readily applicable within each segment (with one exception discussed below).
- The same ratios tend to load with similar strength on the same factors.

Factors for the industry segments are compared in Table 7, where the top three loading ratios are listed for each factor. As before, ratios coinciding with those from the full sample analysis are in bold.

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[7]Compustat did not have SIC codes for two firms (indicated by 9999 in table 1). These firms were not included in any of the three subsamples.

Generally, there is strong overlap of the industry segments with the full sample (and between the industry segments). And where the specific ratios listed within a given industry segment differ from the full sample, the ratios still clearly represent the financial dimension with which they are associated.

The one exception appears to be for the 'Liquidity" factor in the Platform subsample. The common thread among the ratios that load here is stockholders equity (SE), rather than current liabilities (CL), as in the full sample and the Electronics and Other segment subsamples. One does not normally think of SE as reflecting Liquidity, but there is a link, given the overall factor pattern. Recall that Claims in the financial accounting model are of three kinds: CL, NL and SE -- and the sum of the three equals Total Assets (TA). Thus if you know two out of the three, then effectively you know all three. And note that the full sample and all the subsamples have a Leverage factor reflecting primarily information about NL. Given a factor reflecting NL, a second factor reflecting either CL or SE provides essentially similar additional information. So while the "Liquidity" label does not describe the specific factor in the Platform subsample very well, the factor still is capturing the similar underlying additional information as in the other samples.

When financial condition changes, does it change along the basic financial dimensions?

So far, the data analyzed in each step of the analysis have been the value of ratios. The existence of basic dimensions means that values of certain ratios tend to be correlated at a point in time. Comparing firms cross-sectionally, firms that tend to have high values for, say, CATA will also have high values for, say, CPFA, because both ratios reflect a more fundamental construct, termed Asset Composition. But firms and their financial condition or financial structure constantly undergo change, sometimes minor, sometimes major. When change occurs over time to financial condition, does it occur along the same basic financial dimensions? When, say, CATA decreases, will CPFA also tend to decrease?

To address these kinds of questions, the focus of the analysis shifts from the

Table 7

COMPARISON OF FACTORS AND REPRESENTATIVE RATIOS ACROSS DIFFERENT INDUSTRY SEGMENTS				
FACTOR	**FULL SAMPLE**	**PLATFORMS**	**ELECTRONICS**	**OTHER**
PROFITABILITY	FACTOR 1:	FACTOR 1:	FACTOR 1:	FACTOR 1:
	NICP	CISA	NISE	**NICP**
	NITA	NISE	CISE	**NITA**
	CITA	**CITA**	**NICP**	**CITA**
LIQUIDITY	FACTOR 2:	FACTOR 7;	FACTOR 2:	FACTOR 2:
	CLSE	TLTA	**CLSE**	**CACL**
	CACL	SASE	**CACL**	**CLSE**
	QACL	TASE	TASE	**QACL**
CASH FLOW	FACTOR 3:	FACTOR 3:	FACTOR 3:	FACTOR 4:
	CFTA	**CFTA**	**CFSA**	**CFTA**
	CFCP	**CFCP**	**CFTA**	**CFCP**
	CFSA	**CFSA**	**CFCP**	**CFSA**
TURNOVER	FACTOR 4:	FACTOR 8:	FACTOR 4:	FACTOR 3:
	SACP	**SATA**	**SACA**	**SACA**
	SATA	**SACP**	**SACP**	SAAR
	SACA	SAFA	**SATA**	SAQA
CASH POSITION	FACTOR 5:	FACTOR 4:	FACTOR 6:	FACTOR 6:
	CHTA	**CHTA**	**CHTA**	**SACH**
	SACH	CHTL	**CHCL**	CHTL
	CHCL	**SACH**	CHTL	**CHCL**
ASSET COMPOSITION	FACTOR 6:	FACTOR 2:	FACTOR 5:	FACTOR 5:
	CPFA	**CATA**	**CPFA**	**CPFA**
	CATA	**CPFA**	**CATA**	**CATA**
	QATA	WCTA	**QATA**	**QATA**
LEVERAGE	FACTOR 7:	FACTOR 5:	FACTOR 8:	FACTOR 8:
	NLCP	**CLTL**	**NLFA**	**NLFA**
	NLFA	**NLCP**	**CLTL**	**NLCP**
	CLTL	**NLFA**	**NLCP**	TASE
INVENTORY	FACTOR 8:	FACTOR 6:	FACTOR 7:	FACTOR 7:
	INCA	**QAIN**	ARIN	**INCA**
	QAIN	**INCA**	**QAIN**	ARIN
	SAIN	**SAIN**	**INCA**	**QAIN**

Table 8

COMPARISON OF FACTORS AND REPRESENTATIVE RATIOS: STATIC vs. DYNAMIC MEASURES		
FACTOR	**RATIO VALUES**	**RATIO CHANGES**
PROFITABILITY	FACTOR 1: NICP NITA CITA	FACTOR 1: **CITA** CICP CISA
LIQUIDITY	FACTOR 2: CLSE CACL QACL	FACTOR 5: **CLSE** TLTA TASE
CASH FLOW	FACTOR 3: CFTA CFCP CFSA	FACTOR 2: **CFTA** **CFCP** **CFSA**
TURNOVER	FACTOR 4: SACP SATA SACA	FACTOR 3: **SATA** **SACP** **SACA**
CASH POSITION	FACTOR 5: CHTA SACH CHCL	FACTOR 6: **CHTA** **CHCL** CHTL
ASSET COMPOSITION	FACTOR 6: CPFA CATA QATA	FACTOR 4: **CATA** **CPFA** **QATA**
LEVERAGE	FACTOR 7: NLCP NLFA CLTL	FACTOR 7: **CLTL** **NLCP** **NLFA**
INVENTORY	FACTOR 8: INCA QAIN SAIN	FACTOR 8: ARIN **QAIN** **SAIN**
INTEREST		FACTOR 9: NIIE CIIE CFIE

values of ratios to measures of change in ratios over time, from a static look to a dynamic look. Operationally, year-to-year differences in ratio values were calculated for all ratios for all firms during the 10-year sample period. And a factor analysis was conducted on these measures of change. The detailed factor pattern results are in Appendix C. Observing the factor patterns and comparing with the Table 4 pattern again leads to some, now familiar, observations:

- One dominant Profitability factor is evident (factor 1).
- Factors 2-8 have comparable eigenvalues.
- The factor labels previously developed are still applicable.
- The same ratios tend to load most heavily on the same factors.

The one new result is a ninth factor with an eigenvalue (1.45) above 1. The ratios that load most heavily on this new factor all reflect "Interest Expense." But all ratios in the sample load more heavily on some other factor (1-8) than they do on Factor 9. Given this, and given the relatively small eigenvalue for Factor 9 compared to the other factors, the extraction of this new factor is not particularly significant.

Table 8 compares the highest loading ratios for these "ratio change" factors with the earlier "ratio value" factors. The overlap is substantial and the individual ratios listed coincide well with the financial dimension with which they are associated. As with the Platform results discussed earlier, the specific ratios loading on the Liquidity factor tend to reflect SE more than CL, but, also as discussed earlier, this does not indicate a fundamental shift in the dimension.

This analysis focusing on change has two implications. Firsts, since similar dimensions are evident here, where the measures manipulated were quite different, there is added support for the validity of the basic financial dimensions. Second, since similar dimensions resulted, the organizing framework implied by the dimensions becomes relevant for both cross sectional and longitudinal investigations involving financial ratios.

A more precise comparison:

A broad finding from most of the previous analysis is that the basic dimensions of

financial conditions, the factors identified, appear quite similar across tests conducted on various different samples. That finding came from the somewhat ad hoc approach of comparing across groups the three ratios that were most representative of specific factors and searching for overlap.

A more formal test of the stability of factors across different circumstances was conducted. What does "stability" imply? It means that ratios that load high (or low) on a particular factor under one condition also load high (or low) on the same factor under a different condition. To test this idea explicitly, the factor loadings (on a given factor) for all ratios from one sample can be correlated with the factor loadings from a different sample. Table 9 shows the results of this type of correlation tests. Correlations coefficients (based on all factor loadings, one for each of the 51 ratios) between the full sample (Table 4) and alternative samples are presented. Reading across the first line (Profitability), correlations range from .95 to .99, indicating that the ratios making up the Profitability factor are virtually identical in all of the samples tested. Ratios that load high (or not) are consistent across the samples.

This same high correlations result tends to hold for all of the eight factors. The lowest correlations are for Liquidity (-.78) and Leverage (.71) in the Platform sample. Recall that the Leverage factor consistently captured ratios incorporating NL, while the Liquidity factor captured ratios incorporating CL and SE. NL, CL and SE, of course, are the broad categories of claims against assets. Thus, the finding here suggests that the pattern of claims within the Platform industry segment differs somewhat from the other industry segments.[8] But the generally strong correlations confirm the robustness and stability of the eight basic financial dimensions.

CONCLUSIONS

[8]The negative sign for Liquidity is not of concern. Individual ratios can be positively or negatively associated with a factor; and a factor in one sample positively or negatively correlated with a factor in another sample. What is important is the degree of association. Recall that the highest loading ratios for this factor sometimes reflected CL and sometimes SE, and that, holding NL constant, NL and SE will be negatively related.

Table 9

CORRELATION OF FACTOR LOADING PATTERNS BETWEEN FULL SAMPLE AND VARIOUS ALTERNATIVE SAMPLES

FACTOR	SAMPLE					
	1983-86	1989-92	PLATFORM	ELECTRONIC	OTHER	RATIO CHANGES
PROFITABILITY	.99	.99	.97	.99	.99	.95
LIQUIDITY	.97	.99	-.78	.97	.96	-.91
CASH FLOW	.99	.98	.98	.99	.98	.98
TURNOVER	.95	.98	.87	.96	.96	.86
CASH POSITION	.99	.99	.95	.98	.95	.90
ASSET COMPOSITION	.92	.98	.91	.95	.86	.95
LEVERAGE	.95	.99	.71	.96	.97	.85
INVENTORY	.97	.99	.89	.90	.94	.95

Summary:

Collectively, the results of the various analyses suggest three broad findings.

1. Dimensions: There are eight basic dimensions of financial condition which underlie the numerous financial ratios that can be constructed for defense industry firms. The dimensions are comprehensive in that they reflect the information (variance) existing in the larger set of individual ratios. The specific dimensions are individually unique in that they are statistically and conceptually distinct from one another.

2. Representative Ratios: Individual ratios can be selected to represent or measure each dimension. These ratios coincide well, both statistically and conceptually, with the basic dimensions.

3. Stability: The framework of dimensions and ratios is robust. It is generally stable across different time periods, different economic circumstances, and different segments of the defense industry. Changes in ratio values occur along the stable basic dimensions.

Comments:

Comparison with Earlier Research: There are many similarities between the taxonomy developed in this study -- for the defense industry -- and those developed in previous research, but also differences. Six (of seven) factors in the early Pinches et.al. taxonomy were found in this study. But there was no evidence for the "Receivables" factor found by Pinches et.al. Differences in receivables is apparently not a major aspect of financial condition in the defense industry. There is considerable overlap between the taxonomy found in this study and the seven dimension taxonomies found by Ketz, et.al. (1990). The most important difference is the identification of an eighth dimension, Asset Composition, not extracted by Ketz et.al. The additional factor indicates that defense industry firms do differ significantly in terms of how they deploy their assets, and that several ratios, creating the Asset Composition dimension, reflect these differences.

A Larger Framework: By themselves, the eight financial dimensions can provide a framework for organizing a financial analysis, but a couple of observations may

enhance the framework. Note first that three dimensions fundamentally reflect aspects of a firm's Operations while the other five reflect aspects of financial Position.

Focusing on Operations: Turnover really reflects the volume of Operations, how well the firm is doing in generating sales. Profitability reflects the success of those operations, how well income is being generated from the sales volume. Cash Flow reflects the degree to which profits are backed up by cash, the conversion of profits into cash flow.

Focusing on Position: Three dimensions reflect the firm's resources (Assets) and two reflect claims against those resources. More specifically, Cash Position, Inventory and Asset Composition each convey information about a firm's actions with respect to the levels of cash and inventory assets, and the mix of current and noncurrent assets. While Liquidity and Leverage convey information about a firm's actions with respect to short- and long-term liabilities (and thus also stockholders' equity). In short,

DIMENSION	CONCEPT
Turnover	Volume of **Operations**
Profitability	Success of **Operations**
Cash Flow	Cash From **Operations**
Cash Position	Cash **Resources**
Inventory	Product **Resources**
Asset Composition	Current/Noncurrent Mix of **Resources**
Liquidity	Short-Term **Claims**
Leverage	Long-Term **Claims**

If one recalls that all financial information from which ratios are constructed are basically measures of Resources, Claims, and Changes. Then the fact that the above

taxonomy covers these three groups in a balanced fashion is somewhat satisfying

Implications:

The findings have implications both for practice and research which focuses on the defense industry. As discussed earlier, financial analysis is practiced at various organizations within DoD, using diverse ratios and approaches. The message implied by the taxonomy is that many ratios are functionally similar to one another. Financial analysis practice might use the taxonomy identified here as an organizing framework for selecting a set of financial ratios which is both comprehensive and sufficient. (This does not preclude selecting ratios based on their known predictive significance, e.g., the apparent association of some individual ratios with, say, bankruptcy. It instead suggests that cognizance of basic financial dimensions can lead to a more efficient utilization of ratio information.)

There are also implications for research. Financial ratios are often used in predictive models, such as for failure prediction (e.g., Dagel and Pepper, 1990; Moses and Liao, 1987, for defense industry firms). Inclusion of more than one ratio from a particular category in such models can lead to significant multicolinearity among ratios. Models constructed in this way may distort the relationship between dependant and independent variables, making the relationships sample-sensitive and the predictions from such models potentially misleading. Hence such model building research may be advanced by knowledge about the functional similarities of ratios.

In summary, both practice and research using financial ratios may benefit from an understanding of the basic dimensions underlying financial ratios and the organizing framework implied by those dimensions.

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APPENDIX A

FACTOR PATTERN
1983-1986 SAMPLE

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
NICP	92 *	14	18	9	12	9	10	-8
NITA	92 *	13	17	9	12	9	10	-9
CITA	90 *	10	19	14	15	11	17	-12
CICP	89 *	10	19	15	14	11	17	-11
NISE	89 *	-15	16	19	11	6	11	3
CISA	88 *	12	15	-23	-11	16	13	-7
NITL	88 *	29	18	1	11	12	8	-15
NISA	88 *	17	13	-25	-15	13	6	-3
CITL	87 *	26	19	6	12	14	14	-18
CISE	85 *	-19	18	25	12	7	19	2
CICL	84 *	42 *	19	5	-6	9	18	1
NIIE	80 *	9	20	4	17	24	-4	-20
CIIE	79 *	4	21	5	20	24	-2	-22
CACL	9	87 *	8	-21	30	11	-1	26
WCIN	15	80 *	14	-12	23	16	33	21
QACL	17	76 *	13	-18	22	23	42 *	19
SACL	22	74 *	17	51 *	8	-3	19	22
WCTA	11	73 *	4	-19	59 *	15	-7	21
TASE	-31	-73 *	-10	25	-6	-19	-7	46 *
TLTA	-30	-77 *	-10	19	1	-20	-11	44 *
CLSE	-16	-90 *	-11	23	27	-10	-11	-1
CFTA	28	7	92 *	15	8	10	12	-3
CFSA	21	13	92 *	-19	-14	10	10	2
CFCP	28	8	92 *	16	6	11	13	-3
CFSE	21	-18	89 *	24	6	4	13	14
CFTL	31	26	87 *	9	3	14	12	-14
CFCL	24	41 *	84 *	5	-14	8	14	10
CFIE	35 *	3	77 *	7	11	24	-2	-23
SACA	16	-16	7	87 *	-27	-17	23	-7
SACP	22	-6	7	79 *	49 *	-5	18	-13
SAAR	13	-4	20	78 *	-13	25	-1	-4
SATA	22	-7	8	78 *	52 *	-6	16	-14
SAQA	-1	-26	-5	76 *	-26	-31	-38 *	-1
SASE	-2	-47 *	-1	73 *	38 *	-16	4	18
GPSA	17	19	-14	-50 *	-10	-4	25	-8
CPFA	12	12	-2	-5	96 *	16	-11	-6
CATA	13	14	-2	-3	95 *	16	-9	-6
SAFA	20	6	2	45 *	85 *	8	3	-10
QATA	21	18	9	-6	74 *	27	49 *	-11
CHTA	20	6	11	3	19	94 *	7	-8
CHCL	19	29	13	0	3	91 *	12	1
CHTL	23	19	13	0	16	90 *	10	-14
CHIE	29	5	19	1	19	84 *	4	-18
SACH	-13	-8	-9	17	-3	-96 *	-5	4
QAIN	22	16	20	-1	3	25	89 *	-3
ARIN	15	17	6	-7	-2	-15	86 *	-7
SAIN	24	2	21	48 *	-12	6	79 *	-7
INCA	-22	-16	-20	1	-3	-25	-89 *	3
NLFA	-28	13	-7	-3	21	-12	-13	88 *
NLCP	-32	4	-1	-3	-36 *	-16	-5	85 *
CLTL	22	-37 *	-2	11	46 *	13	1	-75 *

: Printed values are multiplied by 100 and rounded to the nearest integer.
Values greater than 0.342537 have been flagged by an '*'.

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
11.644636	6.581463	6.199739	5.426424	5.327837	5.269214	4.226893	3.195024

APPENDIX A (Continued)

FACTOR PATTERN
1989-1992 SAMPLE

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
NICP	90 *	15	9	12	-15	4	-2	1
NITA	90 *	16	9	12	-15	4	-2	2
CICP	88 *	18	17	14	-23	6	4	4
CITA	88 *	18	17	13	-23	6	4	5
NISE	88 *	6	9	-11	12	2	-3	-1
NISA	87 *	-31	4	0	-1	5	3	1
NITL	86 *	13	9	22	-26	5	0	2
CISE	84 *	8	16	-17	12	4	-1	1
CISA	84 *	-37 *	6	-3	-8	8	12	4
CITL	82 *	14	14	28	-36 *	6	7	4
CICL	81 *	14	16	43 *	-8	-1	1	7
NIIE	80 *	13	6	10	-29	-2	13	-1
CIIE	74 *	13	5	14	-36 *	-2	21	6
SATA	24	85 *	20	22	-24	13	-11	1
SACP	25	84 *	21	23	-25	13	-11	0
SACA	20	77 *	27	12	-4	-45 *	-15	7
SASE	-11	73 *	10	-37 *	48 *	11	-12	3
SAQA	14	71 *	14	9	0	-41 *	-26	-42 *
SAFA	19	71 *	8	22	-19	57 *	-2	-6
SAAR	3	55 *	22	-6	27	9	31	-17
GPSA	1	-55 *	12	6	0	-9	-9	3
CFTA	21	21	94 *	4	-8	-2	4	6
CFCP	22	21	93 *	4	-9	-2	4	6
CFCL	19	14	84 *	41 *	14	-7	3	6
CFTL	29	17	84 *	24	-29	1	4	8
CFSA	7	-45 *	82 *	-17	13	-3	12	9
CFSE	-4	8	79 *	-35 *	38 *	-2	11	11
CFIE	24	12	71 *	9	-36 *	-11	11	18
CACL	10	9	-1	81 *	15	52 *	7	-11
QACL	9	-2	6	70 *	14	54 *	19	34 *
SACL	21	63 *	19	69 *	5	3	-10	3
WCTA	9	15	-4	68 *	10	67 *	9	-13
CLSE	-24	-4	-8	-90 *	31	10	1	6
NLCP	-34 *	-4	-2	2	91 *	-15	-9	-3
NLFA	-33	-2	-9	1	85 *	25	-7	-7
TASE	-30	-6	-6	-61 *	71 *	2	-5	5
TLTA	-31	-6	-7	-60 *	71 *	0	-6	4
CLTL	26	4	-1	-30	-86 *	21	11	3
CATA	6	10	-10	6	-5	96 *	15	-5
CPFA	5	10	-10	6	-4	96 *	15	-5
QATA	9	-4	4	4	-8	81 *	26	48 *
WCIN	11	-2	3	59 *	11	63 *	21	28
CHTA	5	2	9	-5	-4	18	95 *	10
CHCL	4	1	9	25	10	13	93 *	8
CHTL	13	3	9	12	-23	16	92 *	8
CHIE	15	2	7	4	-34 *	3	86 *	15
SACH	4	34	1	15	-9	-16	-89 *	-12
QAIN	2	-21	10	-5	3	21	27	90 *
SAIN	9	28	27	-2	6	-8	14	86 *
ARIN	8	-5	6	9	-19	-18	-15	83 *
INCA	-2	21	-10	5	-3	-21	-27	-90 *

TE: Printed values are multiplied by 100 and rounded to the nearest integer.
Values greater than 0.337019 have been flagged by an '*'.

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
10.593900	5.690242	5.620645	5.341713	5.178202	5.099113	4.942086	3.875478

APPENDIX B (Continued)

FACTOR PATTERN
ELECTRONICS SAMPLE

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
NISE	91 *	-17	13	3	14	2	0	8
CISE	91 *	-20	13	8	8	6	10	6
NICP	91 *	20	19	13	11	4	0	-14
NITA	91 *	20	19	14	12	4	0	-14
CICP	90 *	22	19	18	7	7	8	-17
NISA	89 *	1	13	-28	14	9	-8	5
CITA	89 *	22	20	19	8	8	8	-17
CISA	89 *	0	12	-29	10	15	-2	1
NITL	85 *	33	19	11	12	6	1	-20
NIIE	84 *	21	16	6	5	15	6	-22
CITL	83 *	38 *	18	14	7	10	7	-25
CICL	83 *	45 *	19	11	0	8	12	-3
CIIE	80 *	24	13	8	0	19	16	-26
CACL	19	86 *	5	9	40 *	12	-6	15
WCTA	19	77 *	4	12	54 *	16	-8	12
QACL	22	72 *	11	-2	51 *	22	25	13
SACL	18	72 *	17	60 *	5	-3	15	3
WCIN	18	66 *	10	-1	60 *	18	15	22
TLTA	-25	-80 *	-9	-14	-3	-10	13	47 *
TASE	-25	-81 *	-9	-16	-2	-10	14	47 *
CLSE	-21	-94 *	-9	-14	9	-4	13	12
CFSA	20	-8	91 *	-26	7	7	7	4
CFTA	27	13	90 *	25	5	6	5	-8
CFCP	27	13	90 *	25	5	6	5	-8
CFSE	14	-28	89 *	10	10	1	17	14
CFCL	27	36 *	85 *	20	-3	7	8	4
CFTL	30	30	84 *	21	4	10	3	-19
CFIE	32	12	76 *	15	-12	17	18	-26
SACA	5	11	17	88 *	-31	-17	9	-3
SACP	13	32	13	87 *	16	-7	12	-20
SATA	13	32	13	87 *	16	-7	12	-20
SAQA	-3	4	6	77 *	-42 *	-22	-35 *	-4
SASE	-11	-47 *	4	73 *	13	-13	25	23
SAFA	18	34 *	7	70 *	52 *	5	10	-22
SAAR	11	-2	25	67 *	6	12	-27	-7
CPFA	17	17	1	3	94 *	17	4	-13
CATA	17	17	1	3	93 *	17	3	-13
QATA	18	7	9	-3	82 *	19	45 *	-16
CHTA	11	1	7	-4	20	96 *	-5	-2
CHCL	14	27	9	-1	10	93 *	-6	7
CHTL	17	24	10	0	17	91 *	-6	-15
CHIE	22	10	13	1	1	87 *	14	-20
SACH	-5	13	-1	38 *	-17	-89 *	4	-9
ARIN	3	7	10	-4	0	-10	93 *	7
QAIN	12	-4	14	-15	31	10	89 *	1
SAIN	12	-2	25	36 *	-1	-5	86 *	-6
GPSA	6	19	9	-21	17	14	-47 *	-9
INCA	-12	4	-14	15	-31	-10	-89 *	-1
NLFA	-25	-14	-9	-14	18	-2	7	91 *
NLCP	-27	-18	-6	-11	-23	-7	3	90 *
CLTL	17	-18	3	7	28	7	-2	-91 *

TE: Printed values are multiplied by 100 and rounded to the nearest integer.
Values greater than 0.342466 have been flagged by an '*'.

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
11.296458	7.028772	6.002944	5.859242	4.772254	4.766077	4.284961	3.840858

APPENDIX B (Continued)

FACTOR PATTERN
OTHER SAMPLE

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
NICP	91 *	13	8	7	22	7	5	-12
NITA	91 *	13	8	7	23	6	5	-12
CITA	88 *	13	19	16	11	10	19	-16
NITL	87 *	25	4	9	20	12	1	-23
NISE	87 *	-14	9	7	14	1	7	19
CICP	87 *	14	21	16	9	11	21	-16
NISA	86 *	17	-32	12	-4	8	0	2
CICL	85 *	38 *	12	19	-10	6	8	-8
CITL	84 *	25	15	16	10	16	14	-27
CISA	84 *	15	-23	23	-15	10	13	-1
CISE	82 *	-18	22	20	1	2	24	17
NIIE	80 *	23	-5	15	21	11	1	-24
CIIE	78 *	19	1	21	20	12	9	-27
CACL	18	91 *	-8	3	12	14	-26	7
QACL	26	84 *	-9	16	17	26	26	5
WCIN	18	81 *	0	10	21	30	32	1
WCTA	21	79 *	-6	1	46 *	18	-23	-1
TASE	-31	-62 *	11	-15	-23	-22	1	60 *
TLTA	-32	-63 *	1	-16	-16	-25	-3	59 *
CLSE	-23	-87 *	12	-14	18	-13	11	29
SACA	14	-18	89 *	3	-10	-13	28	-15
SAAR	0	0	89 *	17	3	0	-4	15
SAQA	1	-16	86 *	-11	-21	-24	-30	-10
SACP	23	-1	78 *	3	46 *	6	26	-21
SATA	23	-3	76 *	3	50 *	4	25	-20
SASE	-5	-56 *	69 *	-12	18	-13	14	32
SACL	26	67 *	67 *	7	3	0	-2	-4
GPSA	22	-14	-54 *	9	-38 *	5	26	5
CFTA	27	5	11	92 *	11	12	15	-9
CFCP	27	6	14	91 *	9	13	16	-10
CFSA	11	7	-40 *	86 *	-21	10	2	6
CFCL	25	43 *	1	83 *	-17	8	-2	0
CFSE	8	-40 *	18	80 *	-7	-2	16	31
CFTL	35 *	27	10	78 *	12	19	11	-30
CFIE	25	21	-4	69 *	26	15	14	-33
CPFA	16	17	2	-1	94 *	18	1	-8
CATA	16	20	6	-1	92 *	20	4	-9
QATA	23	12	-3	9	76 *	25	51 *	-11
SAFA	21	8	53 *	2	75 *	11	17	-16
CLTL	21	-19	20	3	64 *	19	24	-59 *
CHTA	13	11	1	11	22	93 *	21	-8
CHCL	14	31	-1	11	2	92 *	13	-4
CHTL	18	21	1	12	21	88 *	18	-20
CHIE	15	19	-7	15	29	80 *	18	-25
SACH	-7	-11	26	-10	-7	-94 *	-13	3
ARIN	18	-9	1	3	6	15	91 *	-20
QAIN	17	2	-4	19	16	26	91 *	-3
SAIN	18	-12	48 *	16	3	10	80 *	-7
INCA	-17	-2	4	-19	-16	-26	-91 *	3
NLFA	-31	-7	-21	-9	-18	-22	-23	82 *
NLCP	-29	-13	-11	-10	-55 *	-24	-19	68 *

TE: Printed values are multiplied by 100 and rounded to the nearest integer.
Values greater than 0.343159 have been flagged by an '*'.

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8
11.206351	6.564384	6.034420	5.509668	5.441942	5.140184	4.701172	3.447223

APPENDIX C

FACTOR PATTERN
RATIO CHANGE MEASURES

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8	FACTOR9
CITA	95 *	9	13	3	-6	8	-4	0	1
CICP	95 *	9	12	2	-6	9	-5	1	0
CISA	94 *	5	-7	-1	0	13	1	-3	-3
NICP	92 *	7	2	8	-20	-7	-2	5	9
NITA	91 *	6	3	9	-20	-7	-2	5	9
CISE	91 *	8	2	0	13	2	3	0	-4
CICL	91 *	9	13	1	-19	12	11	4	-1
NISA	91 *	3	-15	5	-15	-4	1	2	6
CITL	90 *	8	13	4	-22	14	-9	2	2
NISE	88 *	3	-7	8	-3	-13	2	5	6
NITL	87 *	5	4	10	-31	-1	-6	5	11
NIIE	69 *	1	1	5	-13	15	-5	-1	63 *
CIIE	68 *	3	3	3	-3	25	-4	-7	58 *
GPSA	54 *	5	9	5	4	16	9	-15	-22
CFTA	10	97 *	15	1	-3	5	-5	4	1
CFCP	10	97 *	16	0	-3	5	-5	4	0
CFSA	7	95 *	-11	-1	0	9	-1	3	-4
CFTL	12	92 *	16	1	-19	11	-9	5	3
CFSE	5	91 *	12	2	25	3	7	4	-6
CFCL	14	90 *	15	-1	-19	12	13	6	-5
CFIE	7	72 *	4	-2	-3	19	-6	-2	52 *
SATA	9	12	93 *	17	-6	-7	-11	8	7
SACP	8	13	93 *	16	-6	-7	-12	9	6
SACA	2	11	84 *	-45 *	-6	-18	-3	2	-1
SACH	2	11	84 *	-45 *	-6	-18	-3	2	-1
SAQA	4	5	68 *	-46 *	-3	-28	-3	-35 *	-7
SACL	21	10	64 *	8	-51 *	5	40 *	14	4
SAAR	1	27	59 *	-12	-6	30	8	-21	-23
CATA	11	-4	-11	95 *	4	16	-6	3	1
CPFA	10	-3	-10	93 *	5	13	1	1	0
QATA	3	7	-13	79 *	2	30	-3	43 *	4
SAFA	12	8	62 *	70 *	-1	5	-4	9	6
WCTA	20	0	-3	66 *	-46 *	22	45 *	5	0
QACL	13	6	-3	49 *	-46 *	37 *	41 *	37 *	-3
WCIN	13	5	-2	42 *	-42 *	36 *	38 *	35 *	-15
CLSE	-26	-5	-16	5	87 *	-9	-14	4	-3
TLTA	-24	-9	-17	0	84 *	-15	34 *	0	-3
TASE	-26	-6	-16	0	82 *	-6	33 *	5	-5
SASE	-15	6	55 *	12	68 *	-11	22	11	0
CACL	21	1	1	48 *	-56 *	25	50 *	11	-3
CHTA	6	16	-9	24	-4	89 *	1	14	2
CHCL	10	13	-8	18	-20	88 *	16	15	-6
CHTL	10	15	-6	21	-20	88 *	-4	14	1
CHIE	11	10	-14	12	-2	80 *	-2	5	44 *
NLCP	-10	-3	-4	-9	30	-3	91 *	-1	-1
NLFA	-8	-4	-9	38 *	28	-1	81 *	2	-1
CLTL	-3	-1	0	13	10	-7	-95 *	-2	3
ARIN	1	-4	6	2	3	-10	-4	90 *	10
QAIN	-1	8	-14	23	3	37 *	8	79 *	-12
SAIN	3	17	47 *	-6	-2	10	4	78 *	-6
INCA	2	-12	13	-30	-1	-37 *	-5	-76 *	0

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7	FACTOR8	FACTOR9
10.957078	6.148844	5.694735	5.198527	4.528351	4.369892	3.743036	3.451223	1.435759

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